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ORIGINAL ARTICLE

Relationship of aerobic and neuromuscular indexes with specific actions in judo

Relation entre paramètres aérobies et neuromusculaires et actions spécifiques au judo

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KEYWORDS

Aerobic fitness;
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Summary

Objective. – The aim of this study was to verify the relationship of aerobic and neuromuscular indexes with specific situations in judo.

Method. – Eighteen male judokas took part in the study. The following assessments were performed: vertical jump (CMJ) on a force platform; Special Judo Fitness Test (SJFT) to obtain the number of throws and percentage of the maximal heart rate (%HRmax) one minute after the test; match simulation to obtain the peak blood lactate (LACmax) and the percentage of the blood lactate removal (BLR); incremental test to obtain the velocity at the anaerobic threshold (vAT) and peak velocity (PV) reached in the test.

Results. – A significant correlation was observed between the number of throws in the SJFT, the vAT ($r=0.60$; $P<0.01$), PV ($r=0.70$; $P<0.01$) and CMJ ($r=0.74$; $P<0.01$). A significant inverse correlation was found between the LACmax and vAT ($r=-0.59$; $P=0.01$).

Conclusions. – It can be concluded that the performance in the SJFT was determined by the aerobic capacity and power and the muscle power. Athletes with greater aerobic ability (vAT) presented lower blood lactate accumulation after the match.

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MOTS CLÉS

Aptitude aérobie ;
Puissance
musculaire ;
Judo

Résumé

Objectif. – Analyser les relations entre indices aérobies et neuromusculaires avec des actions spécifiques du judo.

Méthodes. – Dix-huit judokas ont participé à cette étude. Ont été réalisées les évaluations suivantes : saut vertical (CMJ) ; Special Judo Fitness Test (SJFT) pour l'obtention du nombre de lancements et du pourcentage de la fréquence cardiaque maximale (%FCmax) ; simulation de

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match pour l'obtention du taux maximal de lactate sanguin (LACmax) et du pourcentage de la diminution de lactate (DLS) ; test incrémental pour l'obtention de la vitesse au seuil anaérobie (SA) et du sommet de la vitesse (SV) atteint dans l'essai.

Résultats. — Il a été observé une corrélation significative entre le nombre de lancements dans le SJFT, la VLA ($r=0,60$; $p<0,01$), SV ($r=0,70$; $p<0,01$) et le CMJ ($r=0,74$; $p<0,01$). Il a été trouvé une corrélation significative inverse entre le LACmax et la SA ($r=-0,59$; $p=0,01$).

Conclusions. — On peut conclure que la performance dans SJFT a été déterminée par la capacité de la puissance maximale aérobie et par la puissance musculaire. Les athlètes ayant la plus grande capacité aérobie (SA) ont présenté une moindre accumulation de lactate sanguin après le match.

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1. Introduction

Judo is a sport whose performance explanation is a complex task, since it can be determined by several physical abilities, besides technical, tactical and also psychological aspects [1–4]. Regarding physical condition and considering that a match of judo can last from a few seconds up to 5 minutes, it is difficult to define a single physiological model to measure the effort involved [5,6]. As a result, there is no consensus in the literature in relation to a single indicator that can be used as a performance predictor or a control variable of a training program.

The main action desired by a judoka during a *shiai* (match in tournament) or *randori* (sparring in which both participants practice attacking and defending) is the throwing of the opponent, seeking scores that lead to winning. This action can occur once or several times, depending on the score for the throw, thus affecting the duration of the match. Therefore, factors that can explain the performance in these situations may range from energy transfer in aerobic and anaerobic metabolism to neuromuscular parameters [4,7].

The requirement for anaerobic metabolism during matches can be demonstrated by the higher lactate concentrations observed after the match [4,8]. In these events, the prolonged maintenance of the rate of energy release is determined in large part by the use of anaerobic sources. High blood lactate concentrations after a maximal effort may indicate a high rate of anaerobic glycolysis, which is associated with the anaerobic capacity of the individual, since more energy is released for muscle contraction [13].

Although the participation of the anaerobic system is determinant in high-intensity exercise, as in the actions performed during judo matches, it has been shown that the aerobic system responds rapidly to the energetic demand in these situations, especially when they occur intermittently [13–15], as is the case of judo matches [5,16]. Besides, the aerobic component is important in cases where the match continues for 5 minutes or more (golden score) and there are sequences of matches on a single day of competition [7].

Considering this aspect, previous studies have shown that the aerobic capacity is related to a lower blood lactate accumulation after *randori* [10,17], and that lactate removal after the match is higher in judokas who use active recovery [9]. Further, the aerobic power appears to be one of the determinant variables in maintaining the intensity in *randori* or *shiai* of maximal duration [7].

In addition, the performance in actions of judo during the match can be attributed to neuromuscular factors such as muscle power, which according to Franchini and Del Vecchio [1] is related to a higher number of attacks and higher efficiency in the throws. The optimization of the power in these throws depends on muscle-elastic mechanisms such as the stretch-shortening cycle (SSC). This phenomenon is evident when the judoka executes a concentric preceded by eccentric phase, in which there is a pre-stretching of the muscle fibers and storage of elastic energy (during the eccentric phase), which is then reused in the concentric contraction resulting in an increase in the efficiency of the movement [18].

Considering the complexity of analyzing performance during a match and in the search for an indicator that best describes this, the present investigation used the number of throws executed in a specific judo test (Special Judo Fitness Test [SJFT]) as the main variable in performance, since the result of this test has been demonstrated as able to accurately discriminate athletes of different competitive levels [7,9]. Thus, this study aimed to verify the relationship of aerobic (peak of velocity, anaerobic threshold velocity, recovery heart rate and removal of blood lactate), anaerobic (peak blood lactate concentration) and neuromuscular (muscle power) indices with the performance in the SJFT.

2. Methods

2.1. Subjects

Eighteen trained male judo athletes took part in this study. Inclusion criteria were the following characteristics: (1) participation in official judo competitions during the same year; (2) training at least three times per week; (3) being a minimum of purple belt (2° *Kyu*); (4) aged 18 years or above; (5) without any kind of injury; and (6) competing in the under 100-kg category. Judokas presented the following characteristics: age of 20.6 ± 1.8 years, experience in the sport of 9.4 ± 4.7 years, body weight of 77.3 ± 13.4 kg, height of 175.6 ± 8.4 cm and body fat of $13.4 \pm 3.3\%$.

2.2. Procedures

All the participants were volunteers and took part in the present study after giving their written consent. All procedures received local ethics committee approval (168/2009).

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